

# **Parametric Evaluation of Interstellar Exploration Mission Concepts**

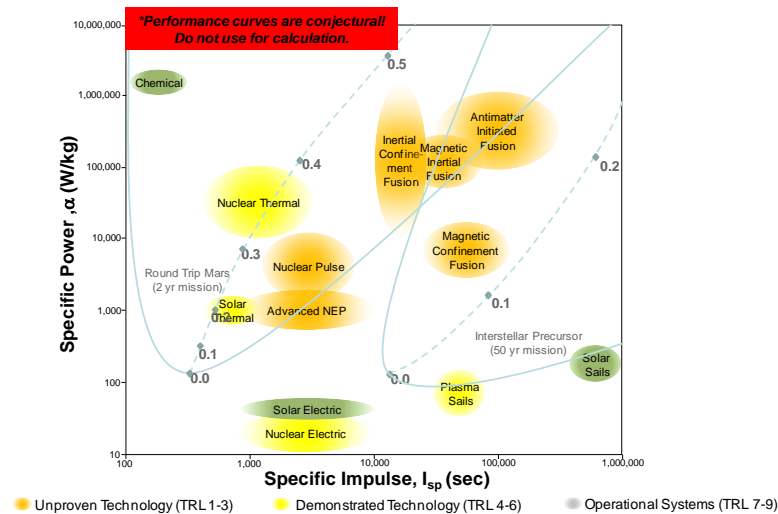
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One persistent difficulty in evaluating the myriad advanced propulsion concepts proposed over the last 60 years is a true apples to apples comparison of the expected gain in performance. This analysis is complicated by numerous factors including, multiple missions of interest to the advanced propulsion community, the lack of a credible closed form solution to 'medium thrust' trajectories, and lack of detailed design data for most proposed concepts that lend credibility to engine performance estimates.

This paper describes a process on how to make fair comparisons of different propulsion concepts for multiple missions over a wide range of performance values. The figure below illustrates this process. This paper describes in detail the process and outlines the status so far in compiling the required data. Parametric data for several missions are calculated and plotted against specific power-specific impulse scatter plots of expected propulsion system performance. The overlay between required performance as defined by the trajectory parametrics and expected performance as defined in the literature for major categories of propulsion systems clearly defines which propulsion systems are the most apt for a given mission.

The application of the Buckingham Pi theorem to general parameters for interstellar exploration (mission time, mass, specific impulse, specific power, distance, propulsion source energy/mass, etc.) yields a number of dimensionless variables. The relationships of these variables can then be explored before application to a particular mission. Like in the fields of fluid mechanics and heat transfer, the use of the Buckingham Pi theorem results in new variables to make apples to apples comparisons.



## Outline

- List of relevant parameters
- Application of the Buckingham pi theorem
- Propulsion equations recast into Pi-variables
- Relationship between Pi-variables (Propulsion)
- Parametric analysis of trajectory options
- Relationship between Pi-variables (Trajectory)
- Conclusions

## References

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